in English. The conciseness of the notation and the difficulty of the subject make these chapters very hard reading. Every one acquainted with the subject is aware that the multiple theta-functions sprang from a brilliant generalisation of Jacobi's functions $\Theta(u)$, $H(u)$, and that the *crux* of the whole matter is to establish, in a natural way, their connection with a set of algebraical functions. It is impossible to feel that this connection has been made in the really proper and natural way: the theta-functions drop out of the clouds, so to speak, and are joined up to the inversion problem in a more or less artificial and unsatisfactory manner. The most promising glimpse of a better method seems to be afforded by the "Prime Form" introduced by Schottky and Klein; and it is very satisfactory that due prominence is given to this function in chapter xiv. (on factorial functions) and elsewhere. It is very important to notice that this function admits of an independent definition, and that the three kinds of elementary Riemann functions may be directly and simply derived from it (see Arts. 233-5). Moreover there is a relation connecting any theta-function with a corresponding prime form (Arts. 237, 272-4). Thus the prime form has a strong claim to be considered fundamental; and it is not improbable that, by starting with it, the same kind of simplification may be attained as that which has been achieved in the theory of elliptic functions by the use of Weierstrass's sigma-function.

It would be unprofitable to attempt to give an abstract of the chapters on the theta-functions which Mr. Baker's book contains; enough to say that (besides the elementary properties) the relations among theta-products, the theory of transformation, and the theory of characteristics are all fully treated; account being taken not only of memoirs already classical, such as those of Rosenhain, Göpel, Hermite, and Weierstrass, but also of quite recent researches, such as those of Prym, Frobenius, Poincaré, and others. A certain amount of special attention is given to the hyper-elliptic case; this is justified by its comparative simplicity, and the large amount of literature connected with it.

Some parts of the book, especially the last two chapters (on complex multiplication of theta-functions, the theory of correspondences, and degenerate Abelian integrals), deal with problems of which the complete solution is still the object of research. This is a very welcome feature; for the unavoidable incompleteness of these parts is more than compensated by their stimulating quality. It is a pity that authors of mathematical treatises too often neglect the opportunity of carrying on a discussion to actual contact with current research, and pointing out the possible or probable direction of future development.

One characteristic of Mr. Baker's treatise seems to call for remark. On p. 93 the author says: "We desire to specify all the possibilities"; this sentence might have been adopted as a motto for the whole work. There is such a wealth of conscientious detail that we can imagine some readers failing to grasp the general argument, and becoming disheartened by the array of complicated formulæ with their plentiful adornment of suffixes. Of course, in order to treat the subject generally, a certain amount of complexity is unavoidable; there is, however, an alternative which can often be adopted, and is worth considering, namely, instead of introducing n symbols, say $x_1, x_2 \ldots x_n$, to use a limited number, say $x_1 x_2 x_3$ or $x y z$, and to give the demonstration in such a form that its generality can be inferred. It must be admitted that this course is not always practicable; the fact is that, in order to read modern analysis with comfort, a certain facility in handling sums and products in a condensed notation is almost indispensable, and should be acquired, if possible, at an early age, as in the analogous case of definite integrals.

The book contains a considerable number of illustrative examples, many of which are worked out in detail. These cannot but be of great help to the reader, by showing how the general theory is brought to bear upon particular cases. This is especially true in the actual construction of the Riemann integrals for a given plane curve.

Printers' errors appear to be very rare; on p. 138, line 14 from the bottom, "not greater than $Q - p$" should be "not less than $Q - p$"; and in the early part of Art. 176 there are several misprints, which, however, the reader can easily correct for himself.

There can be no doubt that this work will be highly appreciated by all who make a special study of Abelian functions; and we trust that, in the approbation of the limited circle to which he appeals, Mr. Baker will find a sufficient reward for the immense amount of labour which his task must have entailed. There is still room for a strictly introductory work, bringing out the salient features of the theory, and perhaps not disdaining "heuristic" methods of investigation. In spite of its limited scope and occasional diffuseness, there is a charm about C. Neumann's book which we miss in the more analytical treatises; something of this kind in English would probably do much to draw attention to this very fascinating field of research, and induce a select few to follow up the somewhat abstruse analysis which a more detailed study of the subject involves. Some reference to the historical evolution of the theory would not be out of place; indeed, we rather regret that the plan of Mr. Baker's treatise has tended to obscure this side of the matter. Cauchy is only mentioned once, and Puiseux not at all; yet the work of these two mathematicians was fundamental, and will always form a part of any systematic discussion of function-theory.

G. B. M.

THE CULTURE OF FRUIT.

The Principles of Fruit-Growing. By L. H. Bailey. Pp. xi + 508. (New York: The Macmillan Company. London: Macmillan and Co., Ltd., 1897.)

FRUIT-GROWING in this country is one of the remedies proposed to counterbalance the effects of low prices for agricultural products. But fruit-growing is an art which cannot be learned without experience. It is no easy matter for a farmer to change his habits and his practices, even if the local conditions are favourable to the production of fruit; and the orchard of the farm is very generally the most neglected part of the whole establishment. Nevertheless, it is obvious that a great extension of fruit culture has taken place during

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the last few years in the vicinity of London and other large towns. At the same time, market-gardening and the growth of grapes, tomatoes and cucumbers under glass have increased enormously, and the production of flowers for market has attained proportions undreamt of by our predecessors, and unthought of even a dozen years ago. Some of those who are among the most successful of these market-growers have been farmers, but farmers possessed of a power of adapting themselves to circumstances denied to many of their fellows. It is curious also, but none the less true, that many of the most successful market-growers—men who send in grapes to Covent Garden by the ton—were not originally either gardeners or farmers. They followed some other occupation, but, deeming it advisable, they altered their plans, took to market gardening, at first on a small scale, but gradually increasing till they became the proprietors of the vast establishments which are now to be seen in every direction round London and in the vicinity of large towns. These men are very shrewd men of business, and they are specialists confining themselves strictly to the cultivation, on an enormous scale, of one or two subjects only. They are not much troubled with principles—of course we are using the word in its scientific meaning!—but they have natural intelligence enough to accumulate experience rapidly, and wit enough to make the most of its application. The private gardeners of this country grow fruit which cannot be excelled, and barely rivalled in any country on the globe; but the cost of production, though by no means lost sight of, is not of such vital moment to them as it is to the market-grower, who has to make his living out of his business.

Putting on one side these two classes of fruit-growers, the market specialists and the gentlemen's gardeners, who both grow fruit well, there remains another class, the largest in numbers, the most widely scattered, and, we fear we must add, the most deficient, alike in principles and in practice. They are neglectful of the one, and unable to appreciate the value of the other. Yet this is the class that is suffering the most severely from agricultural depression, and the one for whose benefit fruit culture is prescribed. It is, however, pretty clear that little advance can be expected in the case of the present generation; it is to the younger generation now coming on that we must look for the results of technical education and technical training that are now more or less available. To these the work before us will be full of suggestions.

Over a large area of the United States fruit culture is carried on to an extent that is hardly realisable here, and it is "much more of a business" than it is with us. The author gives advice as to the locality and climatal conditions under which success may be confidently hoped for, deals with the methods of tillage, cultivation and manuring, and enumerates the most suitable varieties for particular purposes. The best modes of picking, grading, packing and sending to market are discussed. On the whole we find more of the practice than of the principles in this book; but it is so full of information and so replete with suggestion that we shall not cavil at its title, but recommend it to thoughtful cultivators who will be able to adapt it to their own uses—a process rendered easier by the table of contents and index with which the volume is provided.

OUR BOOK SHELF.

Masonry Dams from Inception to Completion, including numerous Formulæ, form of Specification and Tender, Pocket Diagram of Forces, &c. By C. F. Courtney, M.Inst.C.E. Pp. 103 + 33. Appendix. (London: Crosby Lockwood and Son, 1897.)

This book purports to be written for civil and mining engineers, but it is difficult to understand what purpose it is intended to serve. The author very correctly states in his preface that it is not an exhaustive treatise. The book is not sufficiently elementary for students, and contains practically nothing that a waterworks engineer of any experience would not be acquainted with. As regards its use by mining engineers, there is no special reference to the use of masonry dams for mining purposes, or examples given where masonry dams have been used for this purpose.

A scientific treatise may be valuable as a record of the views and experience of an author who has himself been largely concerned in designing and carrying out works of the nature dealt with. This book cannot come under this head, as from the description given on the title-page, it appears that until recently the author had only filled the office of assistant engineer to an Engineering Company and in the City Surveyor's office, Manchester. A treatise may also be of service where the author, having a practical knowledge of the subject with which he deals, collects together and puts into readable form theories, facts and descriptions of works scattered about in scientific proceedings and in the engineering journals. Such a work on the subject here dealt with would be of value, as giving examples of masonry dams which have been constructed in this and other countries, with illustrations of the sections and profiles adopted, and an account of the materials used in the construction. Such information is, however, conspicuous by its absence in the present volume, the only examples given being those of the Quaker Bridge and the Bouzey dams. Even the Vyrnwy dam for the Liverpool water supply, which during its construction excited a very large amount of attention and controversy, is only incidentally referred to.

The chapters on construction and calculations of stability contain some useful information, but nothing that is original or that has not been already as well told in books already in existence, and there are misprints in some of the figures which might prove very misleading if made use of.

It is at present the practice for those engaged in questions of water supply to use as units of measurement acres and square miles as areas, inches for rainfall, and gallons or cubic feet for quantities. The author, however, makes a free use of the metric system, and give a formula for what he terms "simplification of calculation," the units of which are expressed in centimetres and square and cubic metres. In other parts of the book the measurements and quantities are sometimes given in metric, and in other parts in English measures, and in one place the result of kilogrammes per cubic metre is given in pounds per cubic foot.

Biblioteca di Scienze Moderne, No. 1. *Africa: Antropologia della Stirpe Camitica.* By Giuseppe Sergi. Pp. 426. (Turin: Bocca, 1897.)

Prof. Sergi is an anthropologist whose views differ widely from those of other writers on the science, who, he complains, have down to the present left the subject in a state of chaos. In the present work he seeks to apply an improved method to the study of a particular section of mankind, viz. the Hamites of Africa. In subdividing the human race, Prof. Sergi depends on purely physical characters, discarding linguistic facts as untrustworthy as indications of affinity. He draws a broad distinction between what he terms the internal and external physical

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